Japanese Kokai Patent Application No. Sho 60[1985]-79834

JAPANESE PATENT OFFICE
PATENT JOURNAL (A)
KOKAI PATENT APPLICATION NO. SHO 60[1985]-79834

Int. Cl.[4]:	H 04 B 3/02 3/36 9/00
Sequence Nos. for Office Use:	7335-5K J-6538-5K
Filing No.:	Sho 58[1983]-187764
Filing Date:	October 7, 1983
Publication Date:	May 7, 1985
No. of Inventions:	1 (Total of 4 pages)
Examination Request:	Not filed

STRUCTURE OF OPTICAL SUBMARINE REPEATER UNIT

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[There are no amendments to this patent.]

Claim

A structure of an optical submarine repeater unit characterized by the following facts: multiple circuit cases are connected to each other in an electrically insulating manner with a connecting plate and are accommodated in a metallic cylindrical container; the aforementioned metallic cylindrical structure is covered with an insulating layer to form the structure of the

optical submarine repeater unit; in this structure, openings are formed on the peripheral part of the aforementioned metallic cylindrical container; a part of each aforementioned circuit case is exposed from the aforementioned openings; and this part is directly adhered to the aforementioned insulating layer.

Detailed explanation of the invention

The present invention pertains to a structure of an optical submarine repeater unit used for an optical submarine repeater.

Optical submarine repeaters using optical fibers have been developed recently along with the occurrence of optical fibers. Figure 1 shows a schematic structure of such an optical submarine repeater. As shown in this figure, optical submarine repeater unit (2) is accommodated in a pressure proof case (1). Also, as shown in Figures 2(a) and 2(b), multiple circuit cases (3) are accommodated inside said repeater unit (2). As shown in Figure 2(b), a circuit board (11), on which various types of electric parts are mounted, and a high heat generation electric part (16) are installed in each circuit unit (3). The cases (circuit cases) (4) of these circuit units (3) are fixed with screws to connecting plate (5) via electrically insulating layer (6). After the entire structure has been inserted into the cylindrical part, that is, metallic cylinder (7) of a metallic cylindrical container, it is fixed by metallic end surface plate (8) and said cylinder (7) of the container. In that state, said metallic cylindrical container (7, 8) is further accommodated in an insulating layer (indicated by the dotted cross section in the figure) comprised of an insulating cylinder (9) and an insulating end surface plates (10). In this conventional structure, for the heat generated by the electric parts in each circuit unit, the heat conducting path via electrically insulating layer (6) used for insulation between the circuit units acts as the main heat dissipation path to the outermost shell insulating layer (9, 10) of the unit. As a result, the heat resistance increases in said electrically insulating layer (6) and becomes a problem with regard to heat dissipation characteristics.

The purpose of the present invention is to solve the aforementioned problem by providing a structure of an optical submarine repeater unit, which can conduct heat from the case of a circuit unit directly to the outermost shell insulating layer without changing the electrically insulating means in the circuit, and which has good durability as well as sufficient mechanical characteristics and heat dissipation characteristics.

The present invention provides a structure of an optical submarine repeater unit characterized by the following facts: multiple circuit cases are connected to each other in an electrically insulating manner with a connecting plate and are accommodated in a metallic cylindrical container; the aforementioned metallic cylindrical structure is covered with an insulating layer to form the structure of the optical submarine repeater unit; in this structure,

openings are formed on the peripheral part of the aforementioned metallic cylindrical container; a part of each aforementioned circuit case is exposed from the aforementioned openings; and this part is directly adhered to the aforementioned insulating layer.

In the following, an application example of the present invention will be explained with reference to figures.

Figure 3(a) is a longitudinal cross-sectional view illustrating the optical submarine repeater unit disclosed in the application example of the present invention. Figure 3(b) is a transverse cross-sectional view of Figure 3(a). In these diagrams, (3) represents each circuit unit. As explained in Figures 2(a) and 2(b), a circuit board (11), on which various types of electric parts are mounted, and a high heat generation electric part (16) are installed in circuit case (4). (12), (13), and (14) represent the case covers of circuit case (4). In this case, however, case cover (14) is adhered to an insulating layer that constitutes the outermost shell of the repeater unit. This will be explained later. (5) represents a connecting plate, which insulates, connects, and fixes each case (4) of said multiple circuit units (3), and which is fixed with screws to a metallic cylindrical container comprised of metallic end surface plates (8) and metallic cylinder (17). (6) represents an insulating layer inside the unit used for electric insulation between said circuit cases (4). The outside of the metallic cylindrical container is covered by an outermost shell insulating layer comprised of insulating cylinder (9) and insulating end surface plates (10). In this case, openings (15) are formed on the metallic cylinder (17) of the metallic cylindrical container such that the peripheral part of the metallic cylinder is partially penetrated. The case cover (14) of said circuit unit (3) protrudes from said opening (15). In this way, said cover (14) is brought into contact with said insulating cylinder (9). This is different from the conventional structure shown in Figures 2(a) and 2(b).

To assemble the repeater unit, first, circuit board (11), on which electrical parts are mounted in advance, and high heat generation part (16) are fixed in circuit case (4), and case covers (12), (13), and (14) are installed to form multiple circuit units (3). Then, each circuit unit (3) is connected and fixed to connecting plate (5) via insulating layer (6). Then, [the connecting plate with the circuit units] is inserted into the metallic cylinder (17) of the metallic cylindrical container. After fixing to metallic end surface plate (8), connecting and fixing to metallic cylinder (17) is performed. Case cover (14) is removed temporarily just before the circuit unit is inserted into the metallic cylinder. It is installed again from the circumferential direction of the metallic cylinder. Finally, the metallic parts are covered by the insulating end surface plates (10) and insulating cylinder (9) of the outermost shell insulating layer to form the repeater unit, which is accommodated in a pressure proof container. The heat conduction path in this structure is from case cover (14) directly to the insulating cylinder (9) of the outermost shell of the repeater unit. Very good heat dissipation characteristics can be obtained when it is used in combination with

the conventional heat dissipation path. As far as the mechanical strength of the metallic cylinder is concerned, since case cover (14) has a structure such that it can be installed from outside the metallic cylinder, the cylindrical shape of the cylinder can also be maintained.

As explained above, according to the present invention, without changing the circuit system, the heat that was formerly conducted via two electrically insulating layers is now conducted directly from the circuit units to the electrically insulating layer of the outermost shell. Therefore, the insulating layer [used for heat dissipation] can be formed as one layer, and sufficiently high mechanical strength can be maintained. Consequently, significant effects, such as improvement of reliability, can be realized for an optical submarine repeater and other devices that generate a large amount of heat and accommodate parts whose service lives are easily affected by heat.

Brief description of the figures

Figure 1 is a schematic longitudinal cross-sectional view illustrating an optical submarine repeater. Figure 2(a) is longitudinal cross-sectional view illustrating a conventional structure of an optical submarine repeater unit. Figure 2(b) is a transverse cross-sectional view of Figure 2(a). Figure 3(a) is a longitudinal cross-sectional view illustrating the structure of an optical submarine repeater unit disclosed in the application example of the present invention. Figure 3(b) is a transverse cross-sectional view of Figure 3(a).

1	Pressure proof case
3	Circuit unit
4	Case of circuit unit
5	Connecting plate
6	Insulating layer
7, 17	Metallic cylinders
8	Metallic end surface plate
9	Insulating cylinder
10	Insulating end surface plate
12-14	Case covers
15	Opening
16	High heat generation electric part
17	Metallic cylinder

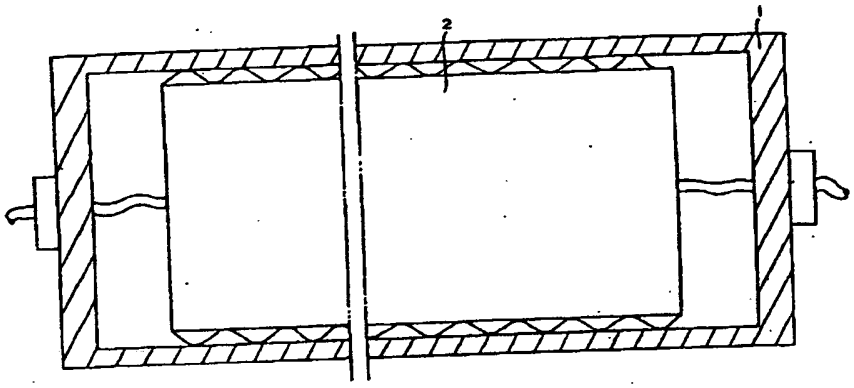

Figure 1

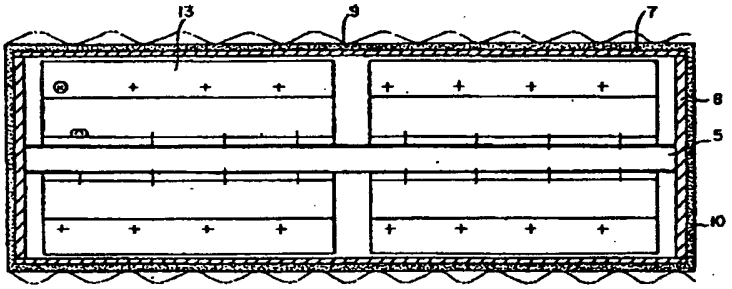

Figure 2a

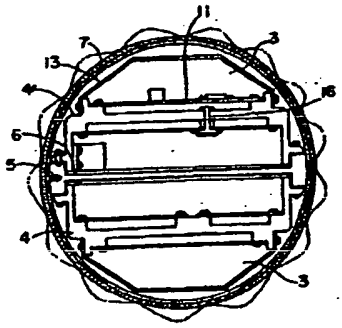

Figure 2b

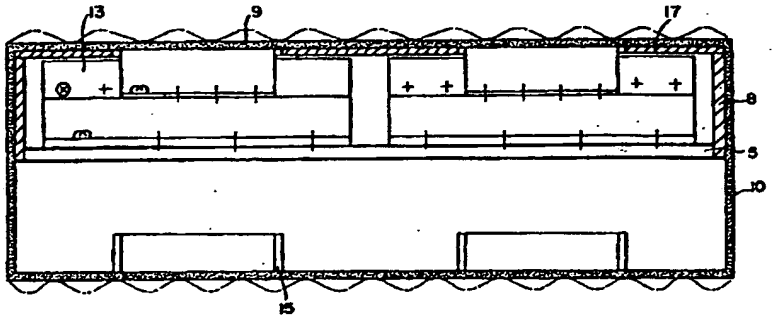

Figure 3a

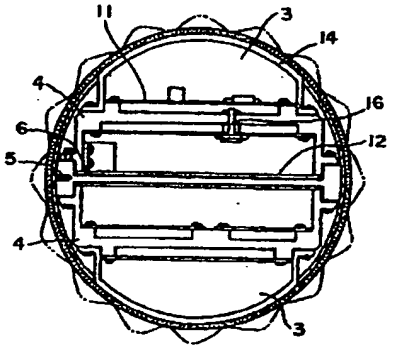

Figure 3b